Technical Newsletter

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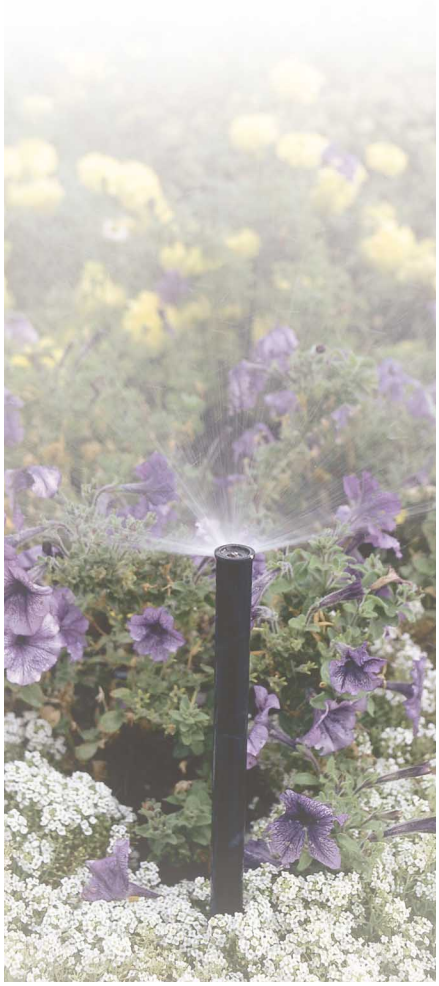
IN THIS ISSUE:

Controller Troubleshooting

ESP Controller Improvements

RASTER Testing



Field-Tested and Fixed in Five!

Rain Bird's Quick Test for Troubleshooting Solid-State Controllers

As surprising as it may sound, half of all controller problems are not caused by defective parts or malfunctions! Rather, they are simple problems that can be easily identified and resolved with a quick test.

Here are steps that will help you understand, troubleshoot, and fix 50% of the problems encountered with today's solid-state controllers.

Best of all, such solid-state controller problems can be field-tested – and possibly fixed – in less than 5 minutes!

A Common Cause: Microprocessor Lockup Problems

The microprocessor is the "brain" of the controller. Occasionally, external electrical problems cause the microprocessor to freeze all functions. Microprocessor problems often cause:

- Blank displays – The display does not show any information.
- Frozen displays – The display shows information that cannot be cleared or changed from the keypad or dial switch. This is also called "lockup."
- Scrambled display – The display shows erratic or out-of-place characters, text or numbers.

The Five-Minute Quick Test can often resolve these micro-processor problems.

Quick Test Steps

Note: This process will delete your existing program!

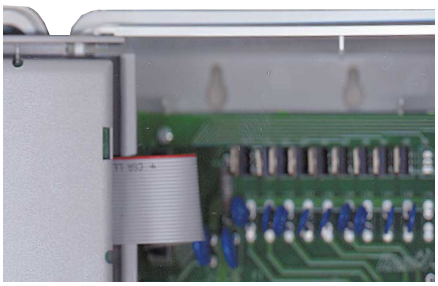
STEP 1

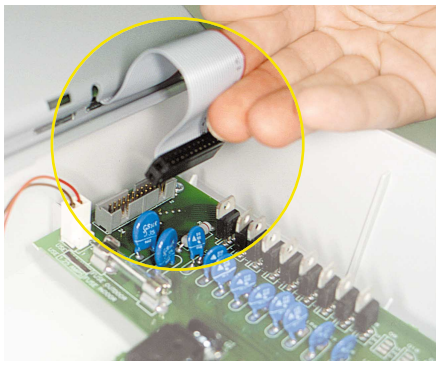
a. Disconnect the controller from its primary power electrical source either by unplugging it from the outlet or by turning off the appropriate circuit breaker in the electrical panel.

OR

b. Disconnect power to the front panel by disconnecting the "ribbon" cable from the terminal board on the ESP-Outdoor, ESP-LX+, ESP-MC or ESP-SAT. These ESP controllers have a one- to two-inch-thick gray plastic ribbon cable that connects the front swing-out panel to the terminal output board on the back of the cabinet.

If you simply disconnect this, you will not have to turn off the primary power.





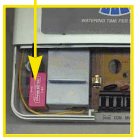
STEP 2.

Disconnect the battery backup from the controller. The backup battery maintains the information inside the microprocessor during a primary power failure. After the battery is disconnected, the *microprocessor should reset itself to its "default" condition* on the ESP, ESP-Si and ESP-TM models.

- Note: Powering down and disconnecting the battery on the ESP-LX+ and ESP-MC will reset only some basic functions (see Step 4b for proper reset procedures).
- The E-Class does not have a battery (see Step 4c).

ESP-SI uses a coin-cell type 3-volt lithium ion battery

ESP, ESP-LX+ and ESP-MC use an NiMH rechargeable battery.

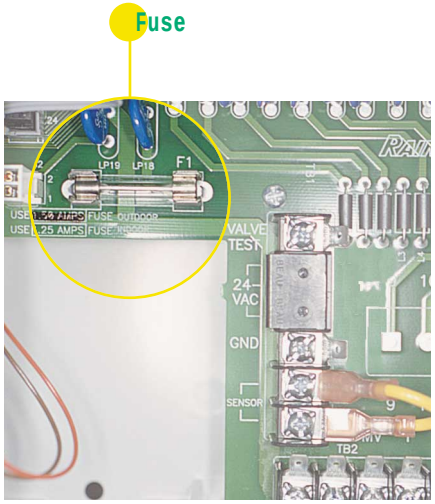


Wait – Maintain this power down condition for 2 minutes. Meanwhile, go on to step 3.

STEP 3.

Make a visual inspection.

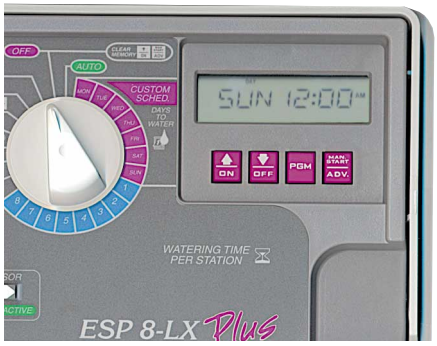
- Remove the fuse and check the filament and amperage rating, replacing the fuse if needed. This step helps clear the microprocessor a little faster.
- Inspect the transformer for damage. Check the 24 VAC leads for proper connections.
- Examine the outside of the front panel, keypads and switch dial for physical damage.
- Check the output board, terminal strip and MOVs (metal oxide varistors) for high voltage effects, such as burn marks or bad traces. Inspect for water damage and corrosion.



STEP 4.

Do the primary power up and function check. ESP Outdoor, ESP-Si & ESP-TM: reconnect the primary power to the controller or panel. A successful reset of the microprocessor should now show 12:00 a.m. in the display.

- If not, repeat Steps 1 through 3.
- If OK, proceed to Step 5.

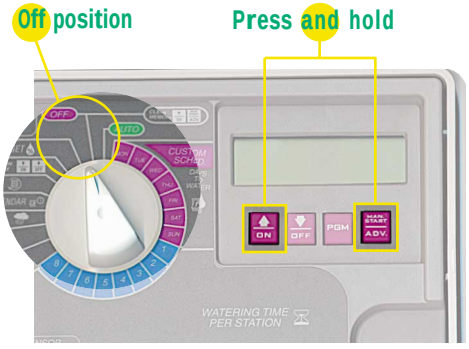


Caution! The following additional steps are required to perform the primary power up and function check for ESP-LX+, ESP-MC, ESP-SAT, E-Class & UNIK/Easy Rain!

b. ESP-LX+, ESP-MC, and ESP-SAT

These controllers have non-volatile memory. You must take additional steps to clear the memory from the EE-PROM chip.

- With power on, turn dial to OFF.
- Press and hold the ON and MANUAL START keys for 10 seconds until the display starts running a self-diagnostic test.
- Discontinue pressing the keys, and wait 20 seconds for the diagnostic test to be completed.
- Check the Time/Calendar function display. It should now read January 1, 199__. This indicates the chip has reverted to its original default mode and should operate properly.



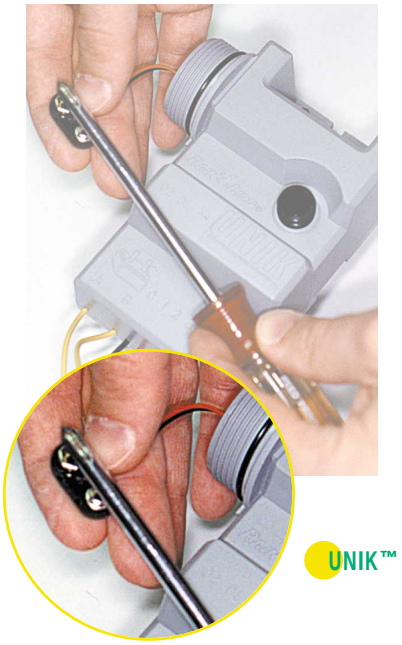
c. E-Class

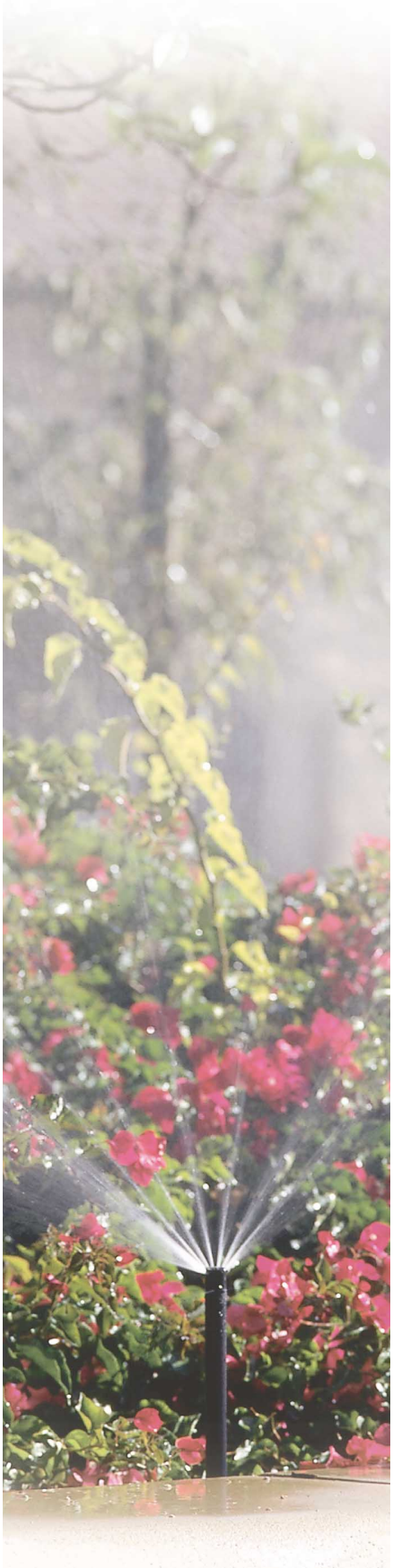
The E-Class controller has non-volatile memory. It does not have a backup battery. It uses a "super capacitor" that holds a charge for 24 hours.

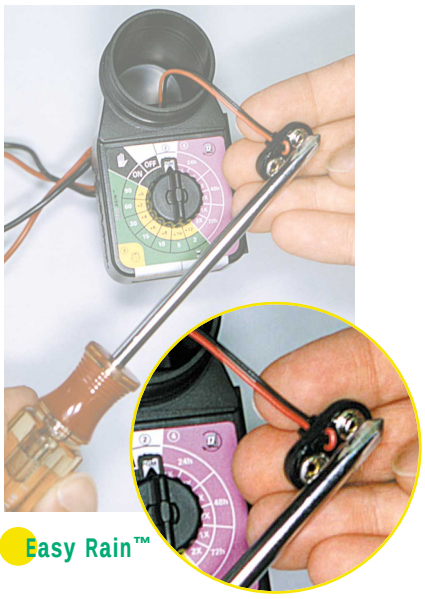
- To reset the microprocessor, turn the dial to AUTO.
- Open and remove the lower cover.
- Use a metal object (small, flat-head screwdriver) to touch and connect the two contacts at the back of the RESET Tunnel. When the display goes blank, remove the screwdriver.
- Check the DATE/TIME mode. The display should read January 1, 199__, 12:00 a.m. This indicates that the chip has reverted to its original default mode and should operate properly.

d. UNIK/ Easy Rain

- Remove the 9-volt battery from the UNIK/Easy Rain valve module.
- Place a metal object across the battery clip leads and hold it there for 60 seconds. This will discharge the capacitor, a type of internal backup power supply. This should reset the microprocessor.
- Install a fresh 9-volt alkaline battery.
- Upload the (allegedly) blank program from the UNIK Valve Module to the UNIK Field Transmitter. The UNIK Field Transmitter should indicate that a program does NOT exist, confirming the successful unlocking of the microprocessor.







STEP 5. Load Test

- Fire up a station. Connect a solenoid to a station on the terminal strip. Initiate a manual start and check solenoid operation.
- Time permitting, try a few more stations.
- If the solenoid doesn't fire up, double-check the primary power by measuring the transformer output. It should be 24 volts, AC current (26.5 VAC @ 120 VAC primary input).
- If the controller is field-mounted, check the common wire connection. Also check for a rain sensor device.

Time Out! All these steps can be completed in less that 5 minutes!

At this point, you should have reset the microprocessor, completed a quick visual inspection, powered up, and fired one station.

This procedure will eliminate half of all problems associated with today's generation of controllers. Remember that faulty field wiring, bad solenoids, high amperage pump starters or poor primary voltage supply can also cause problems.

Extra Testing Tips

Here are other common problem areas with controllers and ways that you may be able to identify and easily correct them.

Short Circuits:

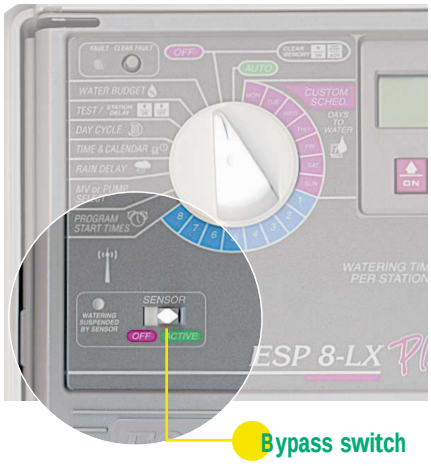
A good wire path to the valve solenoid should read 20 to 60 ohms. A value less than 20 ohms indicates a short, which can cause the fuse to blow, the circuit breaker to trip, or the diagnostic circuit breaker to fault. Measurements over 60 ohms suggest that an open condition exists, which prevents current from flowing to the solenoid. Look for broken wires, bad splices or skinned field wire insulation.

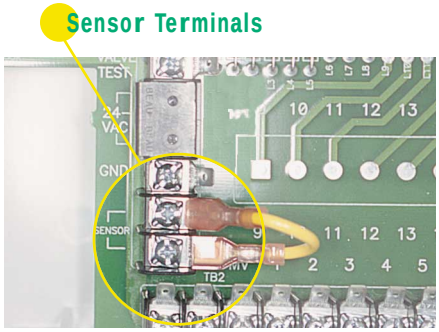
Resistance:

- Disconnect the common wire from the controller.
- Set the volt-ohmmeter (VOM) to the **R x 1** scale and zero the meter. If you are using a Digital Multi-meter (DMM), set it to the 200 ohm (or lowest) scale. Connect one of the VOM or DMM leads to the valve common field wire (not the controller common terminal).
- Touch the second VOM or DMM lead to each of the station terminals and record the resistance readings. Compare your readings to the acceptable range of 20 to 60 ohms.
- See the *Rain Bird Irrigation Trouble-shooting Guide #D37040* for more information.

Sensor Bypass Switch:

If no sensor is attached to the controller, make sure the supplied jumper connects the two SENSOR terminals on the controller's output board. If the sensor bypass switch is set to ACTIVE without a sensor or jumper connected to these terminals, the valves will not operate and no watering will occur. The sensor terminals are connected in-series to the common wire side of the 24 VAC, so a "break" from a rain sensor interrupts the common wire supply directly.





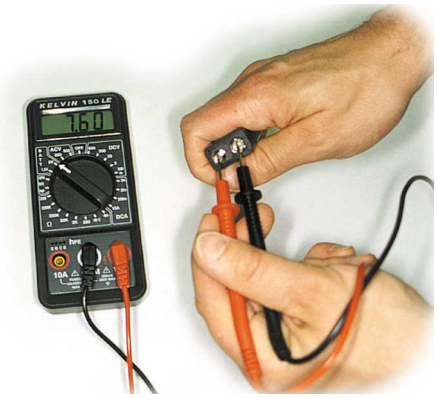
Primary Power:

Rain Bird recommends 120 VAC, plus or minus 10% (108 to 132 VAC), of primary power for domestic controllers. Controllers manufactured for international applications use 230 VAC @ 50 hz. Low input voltage may cause an erratic display or lockup. High voltage spikes may damage the internal board components, including the microprocessor. "Dirty" power accounts for a high percentage of controller "lockup" problems. Follow the Quick Test Steps to reset controller functions.

Battery Backup:

Check the strength of the battery by using a volt-ohmmeter. A reading of 8.4 Volts DC is good for an NiMH battery (7 internal cells X 1.2 volts = 8.4 VDC). Perform a very quick amperage test also, to avoid shorting the battery (a 300 milli-amp reading is considered weak). A poorly charged or dead battery will not supply enough power to maintain the program.

Also check the battery clip for DC voltage. The black and red wires supply



9-volt DC power from the controller. This charges the Ni-Cad (nickel-cadmium) or NiMH (nickel-metal hydride) battery. Remove the battery, and check the metal clip. You should see 9 to 16 volts DC.

The ESP-Si controller uses a 3-volt DC lithium-ion battery. It will sustain the program and time for several months if the primary power is off. It is not rechargeable.

Lightning Protection:

Rain Bird controllers have extensive lightning protection when wired correctly. Following proper grounding procedures greatly enhances the chances products will survive lightning strikes. Rain Bird recommends 0 to 5 ohms for a grounding grid.

Each station has one metal oxide varistor (MOV). The MOVs must have a ground path to work properly. One leg of the MOV is connected to the 24 VAC path to the station terminal, and the other connects to the earth. When excessive voltage travels through the valve wiring, each MOV directs the current flow back to the ground. This stops high voltage from reaching the circuit board.

Remember, solid-state devices, including your home computer, only need 3 to 5 volts DC at the microprocessor to function properly. First, we start with 117 VAC, then lower it to 24 VAC through the transformer. Next, the 24 VAC passes through a *rectifier* changing it into DC current. A *voltage regulator* then reduces the voltage in the panel for the microprocessor, liquid crystal display (LCD) and other board functions.

Technical Update:
ESP Controller Improvements

ESP Retrofit Kits

For ESP-Outdoor manufactured after 11-4-99

For the retrofit connector only:

S634959 Retrofit Connector 14 POS ESP

For domestic front panels:

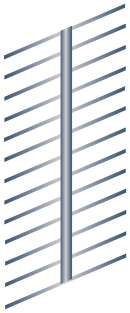
(These have the retrofit connector.)

F18926	ESP 120V/8 ST RPK
F18826	ESP 120V/6 ST RPK
F18726	ESP 120V/4 ST RPK

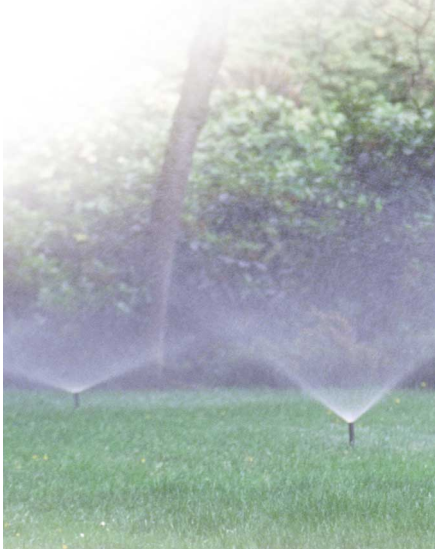
For international front panels:

(These have the retrofit connector.)

F20236	ESP 230V/8 ST RPK
F20136	ESP 230V/6 ST RPK
F20036	ESP 230V/4 ST RPK



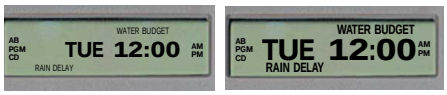
ESP Retrofit Connector



We recently implemented some improvements to the standard ESP's that will offer enhanced quality and user benefits. These changes are a new LCD, the attachment of the ribbon cable to the panel, and the surface mount application of the microprocessor. These improvements are explained in further detail below.

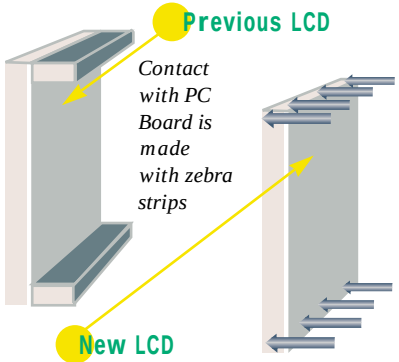
The new LCD has two important benefits:

- Cosmetically the LCD is about 40% larger, it has larger type, and the contrast is greater.



Previous LCD New LCD

- Technically, the LCD went from a zebra strip connector to a pin-hole component. This change will help reduce defective returns for blank, scrambled and/or fading displays.

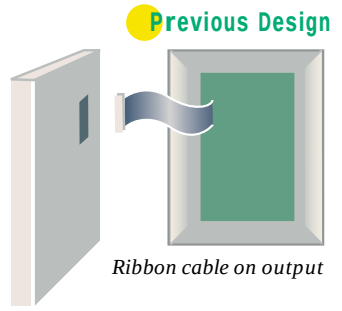


To make contact, the pins of the LCD are soldered to the PC Board

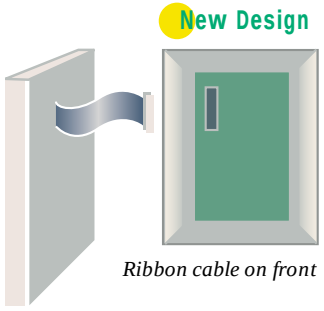
- In order to standardize across our ESP line, the ribbon cable is now attached to the panel. In the past, it was attached to the output board. The new panels are 100% backward compatible with old cabinets, and vice-versa, by the use of a special connector.

This special connector is included with the ESP front panel replacements that are now available as whole goods.

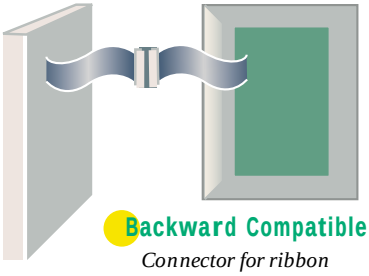
- F18726 ESP-4, Front Panel Replacement
- F18826 ESP-6, Front Panel Replacement
- F18926 ESP-8, Front Panel Replacement



Ribbon cable on output



Ribbon cable on front



Connector for ribbon

- The final change involves the process for attaching the microprocessor to the PC board. The microprocessor is now attached using surface mount technology. This process will significantly improve the reliability of the ESP in high temperature and humidity environments.

Your RASTER Solution: A Diagnostic Tool for Controllers in the Field

Rain Bird's RASTER (Rapid Station Test Routine) offers a simple way to diagnose and troubleshoot field wiring, solenoid and controller problems quickly and easily while in the field. It's a built-in diagnostic option that's available on all ESP-MC, ESP-SAT, ESP-SITE, ESP-LX+ and ESP-Lxi+ controller models.

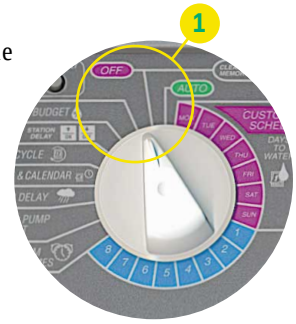
The RASTER sends an electric signal to each valve terminal on the controller and then displays the valve's current operating condition. Results appear in the controller's easy-to-read digital display.

Remember: the RASTER test is a diagnostic tool only and does not affect the operation of the controller.

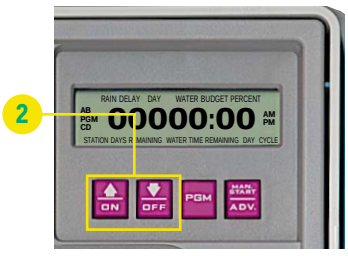
Here's how it works:

TO BEGIN …

1. To begin the RASTER test, turn the programming dial to OFF.

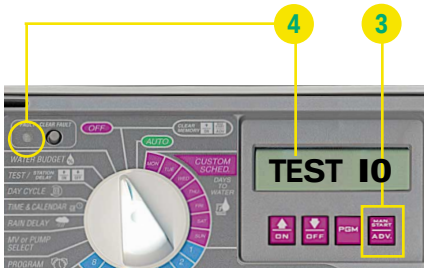


2. Press and release the ON and OFF buttons together. The display (LCD) should show all available characters and graphics. Look for missing segments or erratic display.



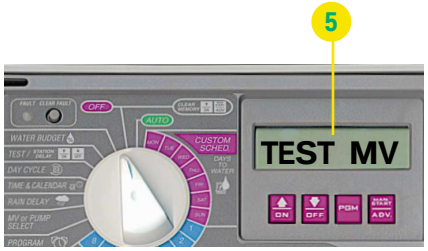
3. Press the MAN. START/ADV. button to begin RASTER testing.

4. The display will show "TEST IO." The fault indicator lights will flash once as the RASTER confirms that the controller's front panel lights are operating properly.

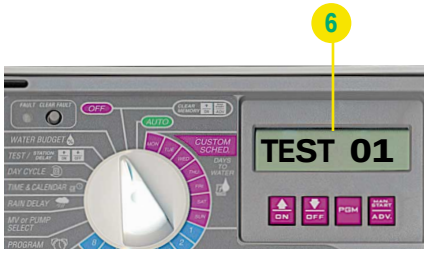


TESTING…

5. RASTER automatically checks the controller's master valve. During this step, ESP LX+ models indicate MV; ESP-MC, ESP SAT and ESP-SITE models show M1 and M2.



6. RASTER then automatically tests each station valve in numerical order. The display briefly shows TEST and the station number.



RESULTS…

7. As the RASTER tests the master valve and all station valves, it displays one of four results for each station. If there is a problem, the RASTER displays the condition of each valve for 10 seconds, before moving to the next valve. If the valve station is good, it will **RAPIDLY** move on to the next. **The test will take less than 5 seconds** if all the field wiring and solenoids check out okay.

Each valve will show one of these results: Pass, Fail, Short, or Open.

PASS

Indicates the valve is operating normally. If all valves pass the RASTER test, the LED flashes "PASS" for 10 seconds and then returns to normal operation.

FAIL

Indicates the controller was unable to send the test signal to the valve. This could be a possible controller malfunction. If any valve displays a "FAIL" message, contact Rain Bird Technical Assistance at 1-800-247-3782 or an authorized Rain Bird distributor to service the controller.

SHORT

Indicates a short circuit or unintended rerouting of current flow somewhere between the controller and the valve.

This may be caused by a shorted valve solenoid, nicked or skinned field wires, or loose or corroded wire connections on the controller's terminal strip at the valve solenoid. It may also indicate a malfunctioning component on the controller's internal circuit board. Check field wires, valve solenoids and wire connectors for possible problems.

OPEN

Indicates a short circuit or complete break in the current flow between the controller and the valve. This may be due to a shorted or malfunctioning valve solenoid, nicked field wire, loose wire connection on the controller's terminal strip or at the valve solenoid, or a damanged component on the controller's internal circuit board

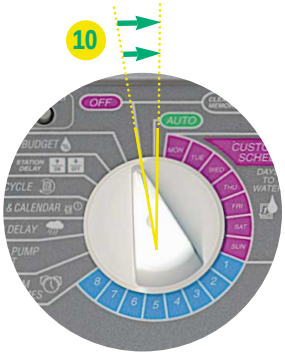
Check field wiring, valve solenoid and wire connectors for any valve showing an OPEN.

Note: Any station not connected to a valve will display an OPEN message. This is normal.

9. After RASTER tests all valves, the LED flashes CHECK for three seconds and then displays for five seconds the operating condition and station number of each valve that did not pass the RASTER test.

TO FINISH…

10. To exit RASTER test mode and return to normal controller operation, turn the Programming Dial to AUTO (or any other dial position) at any time. The controller is ready to operate and will simply await its next scheduled start time.



For Either a SHORT or an OPEN:

- Always make sure valve station wires are securely connected to the controller's terminal strip.
- If wires are secure, move the station's wires to a station that passed the RASTER. Re-start the test.
- If the OPEN or SHORT recurs on the original station, the controller's internal circuitry may need service.
- If the OPEN or SHORT moves to the new station, check the valve's solenoid and field wiring.
- The operator can press MAN.START/ADV at any time during test results to advance to the next station.

RASTER™ (Rapid Station Test Routine) Quick Reference Card

Rain Bird Technical Assistance (800) 247-3782

1 Turn Programming Dial to "OFF" to begin RASTER test.

ESP-MC, ESP-SAT, or ESP-SITE / ESP-LX+ or ESP-LXi+

Press and release ON and OFF buttons together. (SUN 12:00)

Press MAN. START/ADV button.

RASTER tests the front panel lights. (TEST IO)

RASTER tests the master valve. (TEST MV)

NOTE: MV = ESP-LX+ models M1 & M2 = ESP-MC, ESP-SAT, and ESP-SITE

RASTER tests each station valve. (TEST 01)

Press MAN. START/ADV to advance to next station.

2 RASTER tests the master valve and all station valves and displays one of four operating conditions for each valve:

PASS = Valve is operating normally.

FAIL = Controller was unable to send the test signal to the valve (Possible controller malfunction.)

OPEN = Open circuit between the controller and the valve (No valve connected, or a possible cut field wire, faulty solenoid, or loose wire connection.)

SHORT = Short circuit between the controller and the valve (Possible shorted valve solenoid, nicked field wire, or loose wire connection.)

2a PASS (PASS) — If all valves pass the RASTER test, the LED flashes "PASS" for 10 seconds and then returns to normal operation.

2b FAIL (FAIL 08) — If any valve displays a "FAIL" message, contact Rain Bird Technical Assistance or an authorized Rain Bird distributor to service the controller.

2c SHORT (SHORT 05) — This sample LED indicates a short circuit on station valve #5. Check field wires, valve solenoid, and wire connectors for any valve displaying a "SHORT" message.

2d OPEN (OPEN 03) — Check field wiring, valve solenoid, and wire connectors for any valve displaying an "OPEN."

NOTE: Any station not connected to a valve will display an "OPEN" message. This is normal.

3 After RASTER tests all valves, the LED flashes "CHECK" for 3 seconds, and then displays for 5 seconds the operating condition and station number of each valve that did not pass the RASTER test.

(CHECK) LED flashes for 3 seconds as RASTER checks valve condition.

(OPEN 03) Sample LED indicates an open circuit on valve #3.

(SHORT 05) Sample LED indicates a short circuit on valve #5.

(FAIL 08) Sample LED indicates controller failure to send test signal to valve #8.

4 To exit RASTER test mode and return to normal controller operation, turn the Programming Dial to "AUTO" (or any other dial position) at any time.

P/N ######